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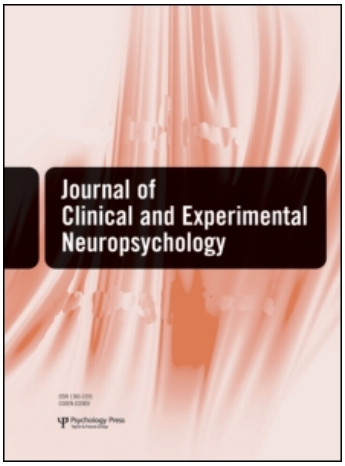

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The effects of psychiatric distress, inhibition, and impulsivity on decision making in patients with substance use disorders: A matched control study

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In the present study, the decision making abilities of patients with substance use disorders were compared to those of healthy controls and, subsequently, the impact of psychiatric distress, behavioral inhibition, and impulsivity on Iowa Gambling Task (IGT) performance were evaluated. A total of 31 patients and 31 matched healthy controls performed the IGT and completed the Symptom Checklist-90-Revised (SCL-90-R) and the Behavioral Inhibition System/Behavioral Activation System (BIS/BAS). The results confirmed that the patient group had severe impairments on the IGT relative to the controls, which appeared to be virtually unrelated to the employed measures. It is concluded that self-reported psychiatric symptoms, behavioral inhibition, and impulsivity have no impact on the IGT performance in this patient sample.

Keywords: Alcohol; Drugs; Addiction; Psychiatric symptoms; Impulsivity; Inhibition; Decision making.

INTRODUCTION

Addiction is increasingly considered a chronic and relapsing brain disorder (Leshner, 1997; McLellan, 2002; Volkow, Fowler, & Wang, 2004). It has consistently been found that the progression of addiction leads to neurochemical and functional disruption of brain regions including the ventral tegmental area, nucleus accumbens, amygdala, and prefrontal cortex (Feltenstein & See, 2008). These regions are considered critical in decision making (Verdejo-García & Bechara, 2009; Verdejo-García, Pérez-García, & Bechara, 2006b). A well-known and frequently applied computerized psychological task that simulates complex real-life decision making is the Iowa Gambling Task (IGT; Bechara, Damásio, Damásio, & Anderson, 1994). Initially, it was shown that patients with lesions in the ventromedial prefrontal cortex perform poorly on the IGT. They choose high immediate monetary gain, which terminates in greater long-term loss as opposed to choices resulting in lower immediate gain and less long-term loss.

More recently, evidence is accumulating that individuals with brain lesions and various mental diseases, including substance use disorders, often perform poorly on tests of decision making and decision making problems in real-life settings compared to healthy controls (Bechara et al., 2001). This concerns psychopaths (Van Honk, Hermans, Putman, Montagne, & Schutter, 2002), patients with suicidal tendencies (Jollant et al., 2005; Jollant et al., 2007), patients with anxiety disorders

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(Miu, Heilman, & Houser, 2008), schizophrenic patients (Kester, Sevy, Yechiam, Burdick, Cervellione, & Kumra, 2006), patients with bipolar disorder (Jollant et al., 2007), depressive patients (Must et al., 2006), and patients with borderline personality disorder (Haaland & Landrø, 2007).

With respect to patients with addictive behaviors, lower scores on the IGT were found in patients with amphetamine use disorder (Gonzalez, Bechara, & Martin, 2007; Hanson, Luciana, & Sullwold, 2008), individuals with alcohol use disorders (Gonzalez et al., 2007; Goudriaan, Oosterlaan, De Beurs, & Van de Brink, 2005), cocaine and heroin polyusers (Verdejo-García, Rivas-Pérez, Vilar-López, & Pérez-García, 2007), heroin addicts with co-occurring psychopathy (Vassileva et al., 2007b), polysubstance users (Hanson et al., 2008), and pathological gamblers (Goudriaan et al., 2005).

In contrast, several studies on comorbid patients with substance use disorders failed to demonstrate statistical significant differences between patients and controls. These diagnostic groups were schizophrenic patients with comorbid cannabis use disorders (Mata et al., 2007; Sevy et al., 2007) and detoxified polysubstance users with comorbid antisocial personality disorder (Vassileva, Gonzalez, Bechara, & Martin, 2007a). Surprisingly, higher levels of antisociality were associated with better IGT performance. Two overview studies (Bechara & Damasio, 2002; Bechara & Martin, 2004) concluded that not all types of substance use disorders manifest IGT impairments.

From a neurobiological perspective it has been suggested that substance use disorders and comorbid psychiatric disorders share common neurobiological pathways, and that abnormalities of these pathways have a negative impact on the course, prognosis, and treatment outcome of these syndromes (Brady & Sinha, 2005; Drake & Brunette, 1998; Rounsaville, Dolinsky, Babor, & Meyer, 1987). Consequently, comorbid conditions are expected to be associated with increased vulnerability to decision-making deficits (Vassileva et al., 2007b).

Currently, there is mounting evidence that personality is a central feature in the development of mental disorders, including substance use disorders (Dawe & Loxton, 2004; Verheul, 2001). It has been demonstrated that alcohol-dependent patients with co-occurring personality disorders, especially Cluster B personality disorders, demonstrate significant impairments in decision making (Dom, de Wilde, Hulstijn, van den Brink, & Sabbe, 2006). The BIS/BAS (Behavioral Inhibition System/Behavioral Activation System) questionnaire (Carver & White, 1994) has been constructed to assess individual differences in personality dimensions that reflect the sensitivity of two motivational systems: the aversive (BIS) and appetitive (BAS) systems (Gray, 1987). In general, the activation of the BIS promotes behavior inhibition (Avila, 2001; Gray, 1987), while perceiving an increased appetitive value of objects (overactivation of the BAS) results in impulsive behavior (Gray, 1987; Iacono, Malone, & McGue, 2008). Therefore, (dis)inhibition and impulsivity are considered important clinical dimensions of patients with substance use disorders. Previous work has demonstrated that the IGT performance is modulated by disinhibition (Crone, Vendel, & van der Molen, 2003). An impaired IGT performance was also found to be connected with high BAS Fun Seeking scores (Suhr & Tsanadis, 2007) and a low score on BAS Reward Responsiveness in nonclinical samples (Franken & Muris, 2005), although Suhr and Tsanadis (2007) did not confirm this relationship. On the contrary, these authors found a statistical trend for an inverse relationship between IGT performance and BAS Drive (Suhr & Tsanadis, 2007). In conclusion, the effects of psychiatric comorbidity and personality makeup on IGT performance have been inconclusive in patients with substance use disorders. Consequently, there has been a recent call for the concurrent assessment of personality and mood with respect to the clinical appraisal of the IGT performance (Buelow & Suhr, 2009).

The first objective of the present study is to compare the IGT performance of an outpatient sample of individuals with substance use disorders to that of matched healthy controls. The second aim is to examine whether people with substance use disorders who present with comorbid psychiatric conditions have more severe impairments in decision making than those who do not have these comorbidities. We take into account self-reported co-occurring psychiatric symptoms (Symptom Checklist-90-Revised; SCL-90-R) and personality (BIS/BAS). It is anticipated that having comorbid conditions in terms of elevated levels of psychiatric symptoms and high levels of impulsivity and lack of inhibition will contribute to a more negative performance on the IGT.

METHOD

Participants

A total of 62 respondents participated in this matched-control study: 31 patients with substance use disorders and 31 healthy controls. The patients were consecutively admitted to the outpatient Bouman Mental Health (GGZ) treatment centre in Spijkenisse, The Netherlands, between March 2007 and August 2008. They all met the *DSM–IV–TR* (*Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition, Text Revision*; American Psychiatric Association, 2000) criteria for substance use disorders. Health professionals conducted the assessment by means of clinical interview and several computerized and non-computerized self-report instruments (see the section "Measures and Procedures"). In this present research patients were not initially assessed for co-occurring formal psychiatric *DSM–IV–TR* diagnoses, whereas symptoms related to substance abuse may exhibit overlap with discrete comorbid conditions. Nevertheless, several past diagnoses were obtained from records that included medical and psychiatric history, such as major depressive disorder and attention deficit hyperactivity disorder, but the manifested symptoms were generally considered mild during assessment. All included patients were nonintravenous substance users and were medically assessed on

TABLE 1
Sociodemographic characteristics

		Patients (n = 31)	*Controls (n = 31)*	*Total (n = 62)*	*t(df)/χ^2(df)*
Age (years)		36.42 (12.21)	36.32 (12.36)	36.37 (12.19)	0.05 (60)
Gender (%)	Male	54.8	51.6	53.2	0.00 (1)
	Female	45.2	48.4	46.8	
Ethnicity (%)	European	100.0	100.0	100.0	
Marital status (%)	Single	51.6	32.3	41.9	5.27 (2)
	Married/living together	41.9	67.7	54.8	
	Divorced	6.5	0	3.2	
Housing (%)	Single	19.4	16.1	17.7	2.06 (5)
	With partner	19.4	25.8	22.6	
	With partner and children	29.0	35.5	32.3	
	Single with children	3.2	6.5	4.8	
	With parents	22.6	12.9	17.7	
	Other	6.5	3.2	4.8	
Education (%)	Lower	12.9	6.5	9.7	3.09 (2)
	Secondary	67.7	54.8	61.3	
	Higher	19.4	38.7	29.0	
Employment (%)	Full-time	53.3	51.6	52.5	11.87 (3)**
	Part-time	16.7	38.7	27.9	
	Unemployed	26.7	0	13.1	
	Other	3.3	9.7	6.6	
Primary addiction (%)[a]	Alcohol	51.6			
	Cannabis	25.8			
	Cocaine	12.9			
	Amphetamine	6.5			
	Benzodiazepine	3.2			
GAF score[b]		56.41 (8.30)			

Note. Mean scores (standard deviations in parentheses) and percentages are given.
[a]The primary addiction corresponds with the "drug of choice" definition applied by Gonzalez et al., 2007, and Verdejo-García et al., 2006a. It reflects the primary substance that was used ≥ 80% of the time during the year that preceded treatment admission. [b]GAF = Global Assessment of Functioning of the *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition, Text Revision* (*DSM–IV–TR*; American Psychiatric Association, 2000).
*$p < .05$.**$p < .01$.***$p < .001$.

transmittable infectious diseases—for example, tuberculosis, hepatitis, and human immunodeficiency virus (HIV). The results indicated that the included patient sample can be considered HIV negative. This is important, since previous research has shown that the HIV status impacts the IGT performance (Gonzalez, Wardle, Jacobus, Vassileva, & Martin-Thormeyer, 2010; Hardy, Hinkin, Levine, Castellon, & Lam, 2006). Characteristics regarding the types of substance are noted in Table 1. The "drug of choice" was defined as the primary substance that was used ≥80% of the time during the year that preceded treatment admission (Gonzalez et al., 2007; Verdejo-García, Bechara, Recknor, & Pérez-García, 2006a).

The control sample was recruited from the same city community and was case-matched for age, gender, ethnicity, and education. These participants completed the Alcohol Use Disorder Identification Test (AUDIT), developed by the World Health Organization (WHO) in order to determine eligibility of participation. The inclusion criterion was an AUDIT score lower than 8 (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). Both groups completed the Mini Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975) prior to the assessment to examine their global cognitive functioning. The criterion for inclusion was a score equal to or higher than 25. Both groups participated on a voluntary basis and gave their written informed consent prior to inclusion. Table 1 summarizes the characteristics of both samples. Both groups only differed with respect to employment status.

Measures and procedures

Iowa Gambling Task (IGT)

A computerized (ABCD) version of the Iowa Gambling Task (IGT) was employed to simulate real-life decision making in terms of rewards and losses (Bechara et al., 1994; Bechara, Damasio, Tranel, & Damasio, 1997). Participants selected cards from four decks that were shown on a display. Two decks (A′ and B′) gave immediate high rewards, though at some unpredictable moment even higher losses resulting in a disadvantageous outcome. Two other decks (C′ and D′) gave smaller immediate rewards though also smaller losses, which resulted in advantageous final outcomes. All participants were

instructed to gain as much money as possible by selecting one card at a time from the four decks until the computer instructed them to stop. The total number of IGT trials was set at 100 card selections. The dependent measures for the IGT performance are the net scores, categorized into five blocks of 20 cards each. A net score is calculated by subtracting the number of cards selected from the disadvantageous decks from the number selected from the advantageous decks: (C′ + D′) – (A′ + B′). Therefore, net scores higher than zero, resulting from choosing a higher proportion of cards from advantageous decks, indicate a gain of money, while net scores lower than zero signify a loss of money and are thus considered disadvantageous (Bechara et al., 2001). The methodology applied by Sevy et al. (2007) was conducted in order to obtain supplementary information regarding the learning curve. Consequently, the sum of the net scores were calculated and dichotomized (1 if sum net scores were equal to or higher than zero; 0 if sum net scores were lower than zero) for both groups corresponding with Trials 1–60 and Trials 61–100. The IGT is considered a sensitive and an ecologically valid measure of decision making (Dunn, Dalgleish, & Lawrence, 2006). In order to increase participants' motivation of adequately completing the IGT, 3 participants of each condition with the highest IGT money gain were transferred a monetary prize contingent on their IGT performance (€10, €20, and €30, respectively).

Symptom Checklist-90-Revised (SCL-90-R)

This 90-item self-report questionnaire was administered to measure psychiatric symptoms (Derogatis, 1983; Dutch version by Arrindell & Ettema, 1986). The response format is a 5-point Likert scale ranging from "not at all" to "extremely." The grand mean is considered a global index of psychiatric distress in individuals with comorbid substance use disorders (Zack, Toneatto, & Streiner, 1998). The Cronbach's alpha of the SCL-90-R grand mean is .98 in the current sample.

Behavioral Inhibition System/Behavioral Activation System (BIS/BAS)

The Behavioral Inhibition System (BIS) and Behavioral Activation System (BAS) were evaluated with the BIS and BAS scales (Carver & White, 1994; Dutch version by Franken & Muris, 2005). It consists of 24 items, scored on a 4-point scale, ranging from "totally agree" to "totally disagree." The BIS system is operationalized by one scale that measures behavioral avoidance or inhibition (7 items). The BIS system regulates aversive motives, in which the goal is to move away from something unpleasant. The BAS system, in contrast, regulates appetitive motives, in which the goal is to move toward something desired. The three subscales are the BAS: BAS Reward Responsiveness (BASRR; 5 items), BAS Drive (BASD; 4 items), and BAS Fun Seeking (BASFS; 4 items). The internal consistency and test–retest reliability are considered sufficient (Jorm et al., 1998). The Cronbach's alphas range in the present study from .63 (BASFS) to .74 (BIS).

Analysis

Continuous variables were compared by means of Student's *t* test, and chi-square statistics were used to evaluate differences in categorical data. Pearson's (zero-order) correlations were calculated to evaluate the associations between IGT net scores, SCL-90-R grand mean, and subscales of the BIS/BAS. IGT data were analyzed using a repeated measures general linear model (GLM), according to the procedure outlined by Bechara et al. (2001). The five trial-blocks were defined as within-subject factors and group (patient or control) as the between-subjects factor. A statistically significant difference was found between both groups on employment status (Table 1), which was subsequently converted into three dummy variables for each subcategory. These dummy variables were subsequently introduced into the GLM as covariates. Planned comparisons were employed to compare the IGT performance of both groups by means of five separate one-way analyses of variance (ANOVAs), while controlling for employment status.

To examine the unique contribution of comorbid psychiatric symptoms and behavioral inhibition and activation systems on the IGT performance, two separate block design hierarchical regression analyses with IGT net score (mean score of 100 card selections) as the dependent variable and either the SCL-90-R grand mean score or BIS/BAS subscales as independent variable were performed. Furthermore, multicollinearity of variables was examined, and additional residual analyses were performed.

All *p*-values were two-sided and were considered significant at $p < .05$. Computations were performed with the Statistical Package for Social Sciences (SPSS Version 15.0, 2004, SPSS Inc., Chicago, Illinois).

RESULTS

IGT performance

With respect to both samples, only 21% of the individuals succeeded in gaining money (i.e., had a positive net score) after 100 card selections. Furthermore, a comparison was made regarding the amount of gained money between patients and controls. A statistically significant difference, $t(60) = 2.37$, $p = .021$, between patients (–1,132.26 USD, SD = 1,064.56) and controls (–386.78 USD, SD = 1,393.14) was observed. Table 2 displays detailed information regarding the unadjusted mean scores of the five IGT trial-blocks. The dichotomized sum net scores for Trials 0–60 differed from the controls in terms of learning, but the difference was not statistically significant (see Table 2). However, for Trials 61–100 this difference was statistically significant ($p = .042$). Moreover, a statistically significant main effect of time for the five IGT trial-blocks was demonstrated, $F(4, 54) = 8.29$, $p < .001$. This effect was positively linear, $F(1, 57) = 13.81$, $p < .001$, as well as negatively quadratic, $F(1, 57) = 13.59$, $p = .001$. These findings suggest that both groups progressively selected more cards from the advantageous decks during

TABLE 2
Unadjusted group effects on SCL-90-R, BIS/BAS, and IGT performance

		Patients (n = 31)	*Controls (n = 31)*	*Total (n = 62)*	*t(df)/χ^2(df)*
SCL-90-R	Total score	171.35 (55.88)	107.90 (23.86)	139.63 (53.28)	5.81 (40.59)***
BIS/BAS[a]	BIS	20.29 (3.44)	19.07 (4.32)	19.69 (3.91)	1.23 (59)
	BASRR	17.10 (2.34)	16.97 (1.94)	17.03 (2.14)	0.24 (59)
	BASD	11.13 (2.93)	10.33 (2.09)	10.74 (2.56)	1.22 (59)
	BASFS	11.61 (2.45)	10.17 (2.04)	10.90 (2.35)	2.51 (59)*
IGT	Total net score	–3.48 (26.33)	21.03 (25.30)	8.77 (28.43)	–3.74 (60)***
	Total score Deck A′	18.52 (7.99)	15.26 (6.78)	16.89 (7.53)	1.73 (60)
	Total score Deck B′	33.29 (9.74)	24.23 (9.29)	28.76 (10.49)	3.75 (60)***
	Total score Deck C′	24.16 (9.93)	21.97 (7.87)	23.06 (8.96)	0.96 (60)
	Total score Deck D′	24.10 (9.33)	38.55 (15.70)	31.32 (14.73)	–4.41 (48.86)***
	Net scores Trials 1–20	–4.71 (5.07)	–5.03 (5.00)	–4.87 (5.00)	0.25 (60)
	Net scores Trials 21–40	–0.84 (8.15)	4.06 (8.03)	1.61 (8.39)	–2.39 (60)*
	Net scores Trials 41–60	0.00 (7.29)	6.13 (7.85)	3.06 (8.12)	–3.19 (60)**
	Net scores Trials 61–80	1.55 (8.54)	7.81 (8.66)	4.68 (9.10)	–2.86 (60)**
	Net scores Trials 81–100	0.52 (8.93)	8.26 (8.53)	4.39 (9.50)	–3.49 (60)**
	Cat. scores Trials 1–60 (0/1)[b]	19/12	11/20	30/32	3.17 (1)
	Cat. scores Trials 61–100 (0/1)	12/19	4/27	16/46	4.13 (1)*

Note. Mean scores (standard deviations in parentheses) and numbers are given. IGT = Iowa Gambling Task. SCL-90-R = Symptom Checklist-90-Revised. BIS = Behavioral Inhibition System. BAS = Behavioral Activation System. BASRR = BAS Reward Responsiveness. BASD = BAS Drive. BASFS = BAS Fun Seeking. Cat. = categorical.
[a]N = 30 in the control group of all BIS/BAS subscales. [b]Categorical scores = 1 if Σ net scores for Trials 1–60 or Trials 61–100 ≥ 0, and = 0 if Σ net scores for Trials 1–60 or Trials 61–100 < 0.
*p < .05. **p < .01. ***p < .001.

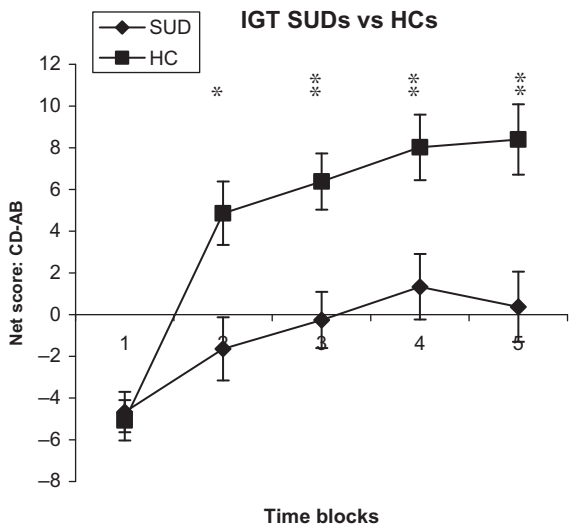

Figure 1. Adjusted means of Iowa Gambling Task (IGT) net scores and comparisons. SUD = patients with substance use disorders. HC = healthy controls. Error bars represent the standard errors of the mean (±*SEM*). *p < .05. **p < .01. ***p < .001.

the later trial-blocks, but that the learning effect attenuated with time. Figure 1 depicts the IGT performance curves of both groups. Further analysis yielded a robust significant main effect of group, $F(1, 57) = 14.95$, $p < .001$, indicating that the patients made more selections from the disadvantageous decks than did the controls. In addition, the interaction effect (Time × Group) yielded a statistically significant trend, $F(4, 54) = 2.38$, $p = .06$. This interaction effect was positively linear, $F(1, 57) = 6.32$, $p = .015$, indicating that the control group showed a more increasing learning effect than did the patient group. In order to examine the differences between the groups, a one-way ANOVA was performed for each of the five trial-blocks. At the first trial block, the IGT scores of the two groups did not differ significantly, $F(1, 57) = 0.08$, $p = .780$. For all subsequent trial blocks, the scores were significantly different: Block 2, $F(1, 57) = 8.38$, $p = .005$; Block 3, $F(1, 57) = 11.07$, $p = .002$; Block 4, $F(1, 57) = 8.25$, $p = .006$; Block 5, $F(1, 57) = 10.30$, $p = .002$.

Effect of personality measures (BIS/BAS)

Table 3 displays the zero-order correlations of the BIS/BAS personality measures and IGT net score. Patients and controls differed only significantly on BAS Fun Seeking (see Table 2). The GLM indicated that the main effect of time remained statistically significant for the five IGT trial-blocks, $F(4, 52) = 2.93$, $p = .03$, when controlling for BASFS. Furthermore, the introduction of BASFS into the GLM as a covariate did not affect the main effect of group, $F(1, 55) = 11.95$, $p < .001$. Furthermore, a regression analysis was conducted to examine the strength of the relation. The group variable and employment were entered in the first step as covariates of the regression equation. In the next step the BASF subscale was added. The accounted variance (R^2) was <1% and was statistically nonsignificant ($\beta = –.02$, $t = –0.12$, $p = .902$).

TABLE 3
Zero-order correlations between IGT, psychiatric distress, and BIS/BAS

	IGT total net score	*Patients (n = 31)*	*Controls (n = 31)*	*Total (n = 62)*
SCL-90-R	Total score	.02	–.30	–.31*
BIS/BAS	BIS	.03	.15	.01
	BASRR	–.11	.16	–.01
	BASD	–.05	.29	.00
	BASFS	–.10	.16	–.13

Note. IGT = Iowa Gambling Task. SCL-90-R = Symptom Checklist-90-Revised BIS = Behavioral Inhibition System. BAS = Behavioral Activation System. BASRR = BAS Reward Responsiveness. BASD = BAS Drive. BASFS = BAS Fun Seeking.
*$p < .05$.

Effect of psychiatric comorbidity measured by SCL-90-R

Table 3 shows a significant correlation between SCL-90-R grand mean scores and IGT net scores ($r = –.31$, $p = .014$) and also a strong association between SCL-90-R grand mean scores and group ($r = .60$, $p < .001$). Because of this correlation, the GLM analysis was omitted. Similar to the aforementioned regression procedure, the group variable employment and the SCL-90-R grand mean score were introduced into the regression model. Again, the accounted variance of the SCL-90-R was negligible (<1%) and statistically nonsignificant ($\beta = –.09$, $t = –0.60$, $p = .550$).

DISCUSSION

The aim of the present study was to compare the IGT performance of individuals with substance use disorders to that of matched healthy controls. In addition, the unique contribution of self-reported co-occurring psychiatric symptoms and the personality attributes of inhibition and impulsivity were taken into account with respect to the IGT scores.

First, consistent with previous findings, we confirmed that outpatient individuals with substance use disorders show poorer performance than healthy controls in decision making, measured by the IGT. While controlling for employment, the patient group made statistically significantly more selections from the disadvantageous decks than did controls. Both groups showed a learning curve during the five IGT trial-blocks sessions, although the control group showed the largest increase regarding the total IGT net score. Overall, our data confirm previous findings of studies comparing patients with substance use disorders to controls (Bechara et al., 2001; Gonzalez et al., 2007; Goudriaan et al., 2005; Hanson et al., 2008; Verdejo-García et al., 2007). Nevertheless, it should be noted that the IGT performance displayed a large variance among both patients and healthy controls. Therefore it is concluded that decision making is not impaired among all substance-dependent individuals.

Second, unexpected findings regarding the impact of psychiatric symptoms and BASFS on IGT performance were obtained. Although common neurobiological pathways and abnormalities have been proposed to underlie impairments in decision making with regard to addictive behaviors and psychiatric comorbidity, the present findings fail to support such commonality. While behavioral mechanisms of impulsiveness and response inhibition may play a plausible role in the loss of behavioral control over substance use, it did not affect the IGT performance. The defects may be attributed to different neural structures.

It seems conceivable that the employed self-report instruments did capture symptoms that are present in psychiatric syndromes, though which are insufficient to meet all of the diagnostic criteria for specific disorders. However, it has been suggested that IGT impairments underlie both substance use disorders and personality disorders in addicted inpatients with comorbid Cluster B personality disorders (Dom et al., 2006). Such "subclinical" syndromes may not reach the threshold of a clinical diagnosis and, consequently, may not reach the threshold of having a negative impact on IGT performance (e.g., Vassileva et al., 2007a).

Additionally, the methodology of the applied assessment may play a role in the present findings. By using self-reports, Franken and Muris (2005) failed to confirm the relation between behavioral decision making and impulsive personality traits (including the BIS/BAS measure) in a nonclinical sample. However, more recently such a relationship has been substantiated by using a task performance procedure, reflecting orbitofrontal functioning (Franken, van Strien, Nijs, & Muris, 2008). These findings suggest that the type of measurement and assessment techniques should be taken into consideration when exploring relationships between underlying biological processes.

Our study has some notable limitations. Although the effects of psychiatric comorbidity and personality on IGT performance were not significant, the role of these conditions on the IGT performance cannot be ruled out completely as the current study examined a typical outpatient sample of patients with substance use disorders and healthy controls. The findings cannot be generalized to other diagnostic groups such as inpatient samples or dually diagnosed patients.

CONCLUSION

Finally, the present findings contribute to the existing body of evidence that substance abuse is associated with impaired decision making. Our findings fail to support the notion that occurrences of psychiatric distress, behavioral inhibition, impulsivity have an additional negative impact on the IGT performance in this patient group. More research is needed regarding the nature and severity of comorbid conditions and associated underlying neural structures that may be involved in impaired decision making in patients with substance use disorders.

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